(University of Delhi)
Shyam Lal College

Programme Outcomes and Course Outcomes

B.Sc. (Physical Science with Physics and Electronics Discipline)

Program Outcomes

Program	Program Outcomes
Bachelors of Science (Physical Science) **Physics and Electronics Discipline**	After studying Physics and Electronics in B.Sc. Program students will be able to: **PO1:** Gain an understanding of the fundamental principles of science governing the behavior of the world around us. **PO2:** sharpen analytical thinking, problem-solving prowess, and critical reasoning which are versatile skills applicable across a multitude of domains. **PO3:** Foster creativity and innovation, encouraging students to think and develop novel solutions to complex problems. **PO4:** fostering collaboration and interdisciplinary approaches to problem-solving. **PO5:** With a strong foundation in mathematics and problem-solving skills, students can excel in roles that involve data analysis, modeling complex systems, and simulations. **PO6:** The students may pursue careers in research institutions or academia, conducting experiments, publishing papers, and teaching at universities and colleges. **PO7:** Science education instills a sense of ethical conduct and professional responsibility in graduates, emphasizing integrity, safety, and adherence to ethical standards in research and practice. **PO8:** The program equips graduates with the skills and knowledge necessary to pursue competitive examinations or enroll in their preferred postgraduate program, providing them with opportunities to advance their academic or professional careers. **PO9:** Students can pursue further education or careers in physics, chemistry, materials science, engineering, education, or related areas.

Program Specifics Outcomes

Program	Program Specific Outcomes
Bachelors of Science (Physical Science) Physics and Electronics Discipline	**PSO1:** Students get acquainted with a comprehensive understanding of core physics principles such as mechanics, electromagnetism, thermodynamics, quantum mechanics, Earth Sciences, relativity, Condensed matter Physics and Nuclear and Particle Physics, **PSO2:** Physics discipline typically requires strong mathematical proficiency. Students get accomplished in mathematical techniques such as calculus, differential equations, linear algebra, and vector calculus. **PSO3:** Students will be proficient in designing, analyzing, and troubleshooting both analog and digital electronic circuits, including amplifiers, filters, oscillators, and digital logic circuits. **PSO4:** Through laboratory courses and experiments, students develop hands-on skills in experimental design, analysis, and interpretation of results, enhancing their ability to apply theoretical concepts to practical situations. **PSO5:** Provide students with the knowledge and skill base that would enable them to undertake further studies in Physics and related areas. **PSO6:** Develop a good understanding of semiconductor materials, device physics, and fabrication techniques, including the operation of diodes, transistors, integrated circuits, and semiconductor devices used in various electronic applications. **PSO7:** BSc Physics and Electronics programs cover topics related to signal processing, modulation, demodulation, and communication systems, preparing graduates for careers in telecommunications, wireless communication, and signal processing industries.

Course Outcomes: B.Sc. Physical Sciences (Discipline-Physics)

Course Name	Learning Outcomes	Methodology (to achieve specific outcomes)
Semester 1:		
Mechanics	**CO1:** Understand the role of vectors and coordinate systems in Physics, solve Ordinary Differential Equations, laws of motion and their application. **CO2:** Learn the concept of Inertial reference frames. **CO3:** Learn the concept of conservation of energy, momentum, and angular momentum and apply them to basic problems. **CO4:** Learn the concept of Particle collision (elastic and inelastic collisions). **CO5:** Learn the concept of Motion of a simple pendulum **CO6:** Understand the special theory of relativity - special relativistic effects and their effects on the mass and energy of a moving object.	1. Use of Visual aids, such as charts, diagrams, graphs, and pictures, to illustrate abstract concepts in physics. 2. Use of visual aids to represent scientific principles, formulas, and experimental setups. 3. Using multimedia resources, including videos, animations, simulations, and interactive software, to provide students with dynamic visual representations of physical phenomena. 4. Blended mode of teaching with a flip classroom approach. 5. Laboratory experiments and practical demonstrations. 6. Use of Online resources, educational websites, virtual laboratories, and online textbooks, such as SWAYAM, NPTEL, Amrita Lab and e-gyankosh. 7. Assessment based upon continuous evaluation including quizzes, assignments projects, presentations, and class tests.
Semester 2:		
Electricity and Magnetism	**CO1:** Demonstrate Gauss law, and Coulomb's law for the electric field, and apply it to systems of point charges as well as line, surface, and volume distributions of charges. **CO2:** Apply Gauss's law of electrostatics to solve avariety of problems. Articulate knowledge of electric current, resistance and capacitance in terms of electric field and electric potential. **CO3:** Calculate the magnetic forces that act on moving charges and the magnetic fields due to currents (Biot- Savart and Ampere laws) **CO4:** Have a brief idea of magnetic	1. Use of Visual aids, such as charts, diagrams, graphs, and pictures, to illustrate abstract concepts in physics. 2. Use of visual aids to represent scientific principles, formulas, and experimental setups. 3. Using multimedia resources, including videos, animations, simulations, and interactive software, to provide students with dynamic visual representations of physical phenomena. 4. Blended mode of teaching with a flip classroom approach. 5. Laboratory experiments and practical demonstrations. 6. Use of Online resources,

	materials, understand the concepts of induction, and solve problems using Faraday's and Lenz's laws	educational websites, virtual laboratories, and online textbooks, such as SWAYAM, NPTEL, Amrita Lab and e-gyankosh. 7. Assessment based upon continuous evaluation including quizzes, assignments projects, presentations, and class tests.
Semester 3:		
Thermal Physics and Statistical Mechanics	**CO1:** Learn the basic concepts of thermodynamics, the first and the second laws of thermodynamics, the concept of entropy and the associated theorems, the thermodynamic potentials and their physical interpretations. They are also expected to learn Maxwell's thermodynamic relations. **CO2:** Know the fundamentals of the kinetic theory of gases, Maxwell-Boltzman distribution law, equipartition of energies, mean free path of molecular collisions, viscosity, thermal conductivity, diffusion, and Brownian motion. **CO3:** Learn about the black body radiations, Stefan-Boltzmann's law, Rayleigh-Jean's law , and Planck's law and their significance. **CO4:** Learn the quantum statistical distributions, viz., the Bose-Einstein statistics and the Fermi-Dirac statistics.	1. Use of Visual aids, such as charts, diagrams, graphs, and pictures, to illustrate abstract concepts in physics. 2. Use of visual aids to represent scientific principles, formulas, and experimental setups. 3. Using multimedia resources, including videos, animations, simulations, and interactive software, to provide students with dynamic visual representations of physical phenomena. 4. Blended mode of teaching with a flip classroom approach. 5. Laboratory experiments and practical demonstrations. 6. Use of Online resources, educational websites, virtual laboratories, and online textbooks, such as SWAYAM, NPTEL, Amrita Lab and e-gyankosh. 7. Assessment based upon continuous evaluation including quizzes, assignments projects, presentations, and class tests.
Semester 4:		
Waves and Optics	**CO1:** Classical wave equation in transverse and longitudinal waves and solving a range of physical systems on its basis. **CO2:** Understand the Concept of normal modes in transverse and longitudinal waves: their frequencies and configurations. **CO3:** Understand Interference as a superposition of waves from coherent sources derived from the same parent source. **CO4:** Demonstrate understanding of	1. Use of Visual aids, such as charts, diagrams, graphs, and pictures, to illustrate abstract concepts in physics. 2. Use of visual aids to represent scientific principles, formulas, and experimental setups. 3. Using multimedia resources, including videos, animations, simulations, and interactive software, to provide students with dynamic visual representations of physical phenomena. 4. Blended mode of teaching with a flip classroom approach.

	Interference experiments: Young's Double Slit, Fresnel's biprism, Llyod's Mirror, Newton's Rings. **CO5:** Demonstrate basic concepts of Diffraction: Superposition of wavelets diffracted from apertures. **CO6:** Understand Fraunhofer Diffraction from a slit. Concept of Polarization.	5. Laboratory experiments and practical demonstrations. 6. Use of Online resources, educational websites, virtual laboratories, and online textbooks, such as SWAYAM, NPTEL, Amrita Lab and e-gyankosh. 7. Assessment based upon continuous evaluation including quizzes, assignments projects, presentations, and class tests.
Semester 5:		
Elements of Modern Physics	**CO1:** Explain how quantum mechanical concepts answersome of the unanswered questions of Classical mechanics such as the photoelectric effect, Compton scattering, etc. **CO2:** Explain the inadequacy of the Rutherford model, discrete atomic spectra from hydrogen-like atoms, and its explanation on a quantum mechanical basis. **CO3:** Demonstrate ability to apply wave-particle duality and uncertainty principles to solve physics problems. **CO4:** Explain two slit interference experiments with photons, atoms, and particles establishing non-deterministic nature of QM. **CO5:** Set up Schrodinger equation for behavior of a particle in a field of force for simple potential and find wave solutions establishing wave-like nature ofparticles. **CO6:** Demonstrate ability to solve 1-D quantum problems including the quantum particle in a box, a well and the transmission and reflection of waves. **CO7:** Explain nuclear structure, binding energy, nuclear models and impossibility of an electron being in the nucleus as a consequence of the uncertainty principle. **CO8:** Understand radioactivity, radioactive decays, apply radioactive laws to solve related physics problems and Pauli's prediction of neutrino, and the subsequent	1. Use of Visual aids, such as charts, diagrams, graphs, and pictures, to illustrate abstract concepts in physics. 2. Use of visual aids to represent scientific principles, formulas, and experimental setups. 3. Using multimedia resources, including videos, animations, simulations, and interactive software, to provide students with dynamic visual representations of physical phenomena. 4. Blended mode of teaching with a flip classroom approach. 5. Laboratory experiments and practical demonstrations. 6. Use of Online resources, educational websites, virtual laboratories, and online textbooks, such as SWAYAM, NPTEL, Amrita Lab and e-gyankosh. 7. Assessment based upon continuous evaluation including quizzes, assignments projects, presentations, and class tests.

	discovery.	
Digital, Analog Instrumentation	**CO1:** Differentiating the Analog and Digital circuits, the concepts of number systems like Binary, BCD, Octal and hexadecimal are developed to elaborate and focus on the digital systems. **CO2:** Characteristics and working of pn junction. · Two terminal devices: Rectifier diodes, Zener diode, photodiode etc. **CO3:** NPN and PNP transistors: Characteristics of different configurations, biasing, stabilization and their applications. **CO4:** CE and two-stage RC coupled transistor amplifier using h-parameter model of the transistor. **CO5:** Designing of different types of oscillators and their stabilities. · Ideal and practical op-amps: Characteristics and applications. **CO6:** Timer circuits using IC 555 providing clock pulses to sequential circuits and develop multivibrators.	1. Use of Visual aids, such as charts, diagrams, graphs, and pictures, to illustrate abstract concepts in physics. 2. Use of visual aids to represent scientific principles, formulas, and experimental setups. 3. Using multimedia resources, including videos, animations, simulations, and interactive software, to provide students with dynamic visual representations of physical phenomena. 4. Blended mode of teaching with a flip classroom approach. 5. Laboratory experiments and practical demonstrations. 6. Use of Online resources, educational websites, virtual laboratories, and online textbooks, such as SWAYAM, NPTEL, Amrita Lab and e-Gyan Kosh. 7. Assessment based upon continuous evaluation including quizzes, assignments projects, presentations, and class tests.
Semester 6:		
Solid State Physics	**CO1:** Elucidate the concept of lattice, crystals and symmetry operations. **CO2:** Understand the elementary lattice dynamics and its influence on the properties of materials. **CO3:** Describe the main features of the physics of electrons in solids: origin of energy bands, and their influence electronic behavior. **CO4:** Explain the origin of dia-, para-, and ferro-magnetic properties of solids. **CO5:** Explain the origin of the dielectric properties exhibited by solids and the concept of polarizability. **CO6:** Learn the superconductivity in solid.	1. Use of Visual aids, such as charts, diagrams, graphs, and pictures, to illustrate abstract concepts in physics. 2. Use of visual aids to represent scientific principles, formulas, and experimental setups. 3. Using multimedia resources, including videos, animations, simulations, and interactive software, to provide students with dynamic visual representations of physical phenomena. 4. Blended mode of teaching with a flip classroom approach. 5. Laboratory experiments and practical demonstrations. 6. Use of Online resources, educational websites, virtual laboratories, and online textbooks, such as SWAYAM, NPTEL, Amrita Lab and e-gyankosh. 7. Assessment based upon continuous evaluation including quizzes, assignments projects, presentations, and class tests.

Course Outcomes: B.Sc. Physical Sciences (Discipline-Electronics)

Semester 1:		
Network Analysis and Analog Electronics	**CO1:** To understand the concept of voltage and current sources, Network theorems, Mesh and Node Analysis. **CO2:** To develop an understanding of the basic operation and characteristics of different type of diodes and familiarity with its working and applications. **CO3:** Become familiar with Half-wave, Full-wave center tapped and bridge rectifiers. To be able to calculate ripple factor and efficiency. **CO4:** To be able to recognize and explain the characteristics of a PNP or NPN transistor. **CO5:** Become familiar with the load-line analysis of the BJT configurations and understand the hybrid model (h- parameters) of the BJT transistors. **CO6:** To be able to perform a small signal analysis of Amplifier and understand its classification. **CO7:** To be able to perform analysis of two stages R-C coupled Amplifier. **CO8:** To understand the concept of positive and negative feedback along with applications of each type of feedback and the working of Oscillators. **CO9:** To become familiar with construction, working and characteristics of JFET and UJT	1. Use of Visual aids, such as charts, diagrams, graphs, and pictures, to illustrate abstract concepts in physics. 2. Use of visual aids to represent scientific principles, formulas, and experimental setups. 3. Using multimedia resources, including videos, animations, simulations, and interactive software, to provide students with dynamic visual representations of physical phenomena. 4. Blended mode of teaching with a flip classroom approach. 5. Laboratory experiments and practical demonstrations. 6. Use of Online resources, educational websites, virtual laboratories, and online textbooks, such as SWAYAM, NPTEL, Amrita Lab and e-Gyan Kosh. 7. Assessment based upon continuous evaluation including quizzes, assignments projects, presentations, and class tests. 1. Hands-on training with various instruments (CRO, DSO, Function generator etc.) 2. Virtual tour of industries.
Semester 2:		
Linear and Digital Integrated Circuits	**CO1:** To understand Op-Amp basics and its various applications. **CO2:** To become familiar with number systems and codes, Logic Gates, and Boolean Algebra Theorems. **CO3:** To understand the minimization techniques for designing a simplified logic circuit. **CO4:** To design a half Adder, Full Adder, Half- Subtractor, Full Subtractor.	1. Use of Visual aids, such as charts, diagrams, graphs, and pictures, to illustrate abstract concepts in physics. 2. Use of visual aids to represent scientific principles, formulas, and experimental setups. 3. Using multimedia resources, including videos, animations, simulations, and interactive software, to provide students with dynamic visual representations of physical phenomena. 4. Blended mode of teaching with a

	CO5: To understand the working of Data processing circuits Multiplexers, DE multiplexers, Decoders, and Encoders. **CO6:** To become familiar with the working of flip-flop circuits, working and applications.	flip classroom approach. 5. Laboratory experiments and practical demonstrations. 6. Use of Online resources, educational websites, virtual laboratories, and online textbooks, such as SWAYAM, NPTEL, Amrita Lab and e-Gyan Kosh. 7. Assessment based upon continuous evaluation including quizzes, assignments projects, presentations, and class tests. 8. Hands-on training with various instruments (CRO, DSO, Function generator etc.) 9. Virtual tour of industries.
Semester 3:		
Communication Electronics	**CO1:** The concepts of electronics in communication, introduction to the principle, performance and applications of communication systems. **CO2:** Various means and modes of communication, electromagnetic communication spectrum with an idea of frequency allocation for radio communication system in India. **CO3:** An insight on the use of different modulation and demodulation techniques used in analog communication **CO4:** Analyze different parameters of analog communication techniques. **CO5:** Learn the generation and detection of a signal through pulse and digital modulation techniques and multiplexing. **CO6:** In-depth understanding of different concepts used in a satellite communication system, Mobile radio propagation, cellular system design and understand mobile technologies like GSM and CDMA, mobile communication generations 2G, 3G, and 4G with their characteristics and limitations.	1. Use of Visual aids, such as charts, diagrams, graphs, and pictures, to illustrate abstract concepts in physics. 2. Use of visual aids to represent scientific principles, formulas, and experimental setups. 3. Using multimedia resources, including videos, animations, simulations, and interactive software, to provide students with dynamic visual representations of physical phenomena. 4. Blended mode of teaching with a flip classroom approach. 5. Laboratory experiments and practical demonstrations. 6. Use of Online resources, educational websites, virtual laboratories, and online textbooks, such as SWAYAM, NPTEL, Amrita Lab and e-Gyan Kosh. 7. Assessment based upon continuous evaluation including quizzes, assignments projects, presentations, and class tests. 8. Hands-on training with various instruments (CRO, DSO, Function generator etc.) 9. Virtual tour of industries.
Semester 4:		
Microprocessor and Microcontroller	**CO1:** Designing and developing embedded systems.	1. Use of Visual aids, such as charts, diagrams, graphs, and pictures, to

	CO2: Major components that constitute an embedded system. **CO3:** The architecture of an 8085 Microprocessor. **CO4:** Assembly language programming essentials **CO5:** A microcontroller, microcomputer embedded system. **CO6:** The architecture of an 8051 microcontroller and its concepts like I/O operations, interrupts, and programming of timers and counters. **CO7:** Interfacing of 8051 microcontroller with peripherals **CO8:** Implementing small programs to solve well-defined problems on an embedded platform.	illustrate abstract concepts in physics. 2. Use of visual aids to represent scientific principles, formulas, and experimental setups. 3. Using multimedia resources, including videos, animations, simulations, and interactive software, to provide students with dynamic visual representations of physical phenomena. 4. Blended mode of teaching with a flip classroom approach. 5. Laboratory experiments and practical demonstrations. 6. Use of Online resources, educational websites, virtual laboratories, and online textbooks, such as SWAYAM, NPTEL, Amrita Lab and e-Gyan Kosh. 7. Assessment based upon continuous evaluation including quizzes, assignments projects, presentations, and class tests. 8. Hands-on training with various instruments (CRO, DSO, Function generator etc.) 9. Virtual tour of industries.
Semester 5:		
Electronic Instrumentation	**CO1:** Learn Accuracy and precision. Significant figures. Error and uncertainty analysis. Shielding and grounding. Electromagnetic Interference. **CO2:** Students will understand about various Measurement Instruments such as voltmeter, multimeters and understand their precision and accuracy. Measurement of Impedance using various bridges. **CO3:** Gain knowledge about power supply, Line and load regulation, Short circuit protection. Idea of switched mode power supply (SMPS) & uninterrupted power supply(UPS). **CO4:** Oscilloscope, CRT and Digital Storage Oscilloscope **CO5:** Study about multivibrators, oscillators, amplifiers and function generators. **CO6:** Gain basic knowledge of	1. Use of Visual aids, such as charts, diagrams, graphs, and pictures, to illustrate abstract concepts in physics. 2. Use of visual aids to represent scientific principles, formulas, and experimental setups. 3. Using multimedia resources, including videos, animations, simulations, and interactive software, to provide students with dynamic visual representations of physical phenomena. 4. Blended mode of teaching with a flip classroom approach. 5. Laboratory experiments and practical demonstrations. 6. Use of Online resources, educational websites, virtual laboratories, and online textbooks, such as SWAYAM, NPTEL, Amrita Lab and e-Gyan Kosh. 7. Assessment based upon continuous evaluation including quizzes, assignments projects, presentations, and class tests.

	virtual instrumentation and transducers.	8. Hands-on training with various instruments (CRO, DSO, Function generator etc.) 9. Virtual tour of industries.
Semester 6:		
Photonic Devices and Power Electronics	**CO1:** Develop an understanding of the application of fundamental laws of physics in such optoelectronics areas as telecommunications and power electronics for automation in industries. **CO2:** Acquire essential laboratory skills in designing experiments, assembling standard optical tools for optical experimentation and power electronics and analyzing acquired data. **CO3:** Identify the critical areas in application levels and derive typical alternative solutions, select suitable power converters to control Electrical Motors and other industry-grade apparatus. **CO4:** Develop an understanding to compare the performance and basic operation of various power semiconductor devices, passive components and various switching circuits. **CO5:** Develop an understanding of the Basic circuit of power rectifiers and inverters.	1. Use of Visual aids, such as charts, diagrams, graphs, and pictures, to illustrate abstract concepts in physics. 2. Use of visual aids to represent scientific principles, formulas, and experimental setups. 3. Using multimedia resources, including videos, animations, simulations, and interactive software, to provide students with dynamic visual representations of physical phenomena. 4. Blended mode of teaching with a flip classroom approach. 5. Laboratory experiments and practical demonstrations. 6. Use of Online resources, educational websites, virtual laboratories, and online textbooks, such as SWAYAM, NPTEL, Amrita Lab and e-Gyan Kosh. 7. Assessment based upon continuous evaluation including quizzes, assignments projects, presentations, and class tests. 8. Hands-on training with various instruments (CRO, DSO, Function generator etc.) 9. Virtual tour of industries.
Basic Instrumentation Skill (SEC)	**CO1**: Course learning begins with a basic understanding of the measurement and errors in measurement. It then familiarizes with every specification of a multimeter, multivibrators, rectifiers, amplifiers, oscillators, and high voltage probes and their significance in hands-on mode. **CO2:** Explanation of the specifications of CRO and their significance. A complete explanation of CRT. **CO3:** Students learn the use of CRO for the measurement of voltage (DC and AC), frequency, and period.	1. Use of Visual aids, such as charts, diagrams, graphs, and pictures, to illustrate abstract concepts in physics. 2. Use of visual aids to represent scientific principles, formulas, and experimental setups. 3. Using multimedia resources, including videos, animations, simulations, and interactive software, to provide students with dynamic visual representations of physical phenomena. 4. Blended mode of teaching with a flip classroom approach. 5. Laboratory experiments and practical demonstrations.

	Students learn the principles of voltage measurement. **CO4**: Students should be able to understand the advantages of electronic voltmeters over conventional multimeters in terms of sensitivity etc. **CO5**: Types of AC millivoltmeters should be covered. **CO6**: Covers the explanation and specifications of Signal and pulse Generators: low-frequency signal generator and pulse generator. Students should be familiar with testing and specifications. **CO7**: Students learn about the working principles and specifications of basic LCR bridges. **CO8**: Hands-on ability to use analog and digital instruments like digital multimeter and frequency counter.	6. Use of Online resources, educational websites, virtual laboratories, and online textbooks, such as SWAYAM, NPTEL, Amrita Lab and e-Gyan Kosh. 7. Assessment based upon continuous evaluation including quizzes, assignments projects, presentations, and class tests.
Electrical Circuits and Network Skills (SEC)	**CO1**: Demonstrate good comprehension of the basic principles of electricity including ideas about voltage, current, and resistance. **CO2**: Develop the capacity to analyze and evaluate schematics of power-efficient electrical circuits while demonstrating insight into the tracking of interconnections within elements while identifying current flow and voltage drop. **CO3**: Gain knowledge about generators, transformers and electric motors. The knowledge would include interfacing aspects and consumer-defined control of speed and power. **CO4**: Acquire the capacity to work theoretically and practically with solid-state devices. **CO5**: Delve into practical aspects related to electrical wiring like various types of conductors and cables, wiring-Star and delta connections, voltage drop and losses. **CO6**: Measure current, voltage, and power in DC and AC circuits, acquire proficiency in the fabrication of regulated power supply. **CO7**: Develop capacity to identify and suggest types and sizes of solid and stranded cables, conduit lengths,	1. Use of Visual aids, such as charts, diagrams, graphs, and pictures, to illustrate abstract concepts in physics. 2. Use of visual aids to represent scientific principles, formulas, and experimental setups. 3. Using multimedia resources, including videos, animations, simulations, and interactive software, to provide students with dynamic visual representations of physical phenomena. 4. Blended mode of teaching with a flip classroom approach. 5. Laboratory experiments and practical demonstrations. 6. Use of Online resources, educational websites, virtual laboratories, and online textbooks, such as SWAYAM, NPTEL, Amrita Lab and e-gyankosh. 7. Assessment based upon continuous evaluation including quizzes, assignments projects, presentations, and class tests.

	cable trays, splices, crimps, terminal blocks and solder.	